NETTS PROJECT/DEMONSTRATION SUMMARY

NCBC-19-96

Title: Subsurface Bioremediation Process Monitoring/Aquifer Flow sensors

Lead PI/Affiliation:Mission Research Corp.

Co-PI's/Affiliations:

Date/Duration:
Initiated - 04/96
Completed - 02/98

Abstract:
Air sparging is the process of injecting clean air directly into an aquifer for remediation of contaminated groundwater. The objective of air sparging is to force air through contaminated aquifer materials to provide oxygen for bioremediation and/or to strip contaminants out of the aquifer. Monitoring devices, installed within a 30-ft radius of the sparge well at one of the sites, 12 neutron probe access tubes, 6 ground water monitoring wells, and 4 innovative soil vapor extraction directional wells.

High-impulse borehole radar imaging is used in the process as a means to image airflow characteristics in the subsurface such as radius of influence, air channeling, and trapped air distribution. A signal, or transient pulse, is radiated into the ground, while the soil acts as a lowpass filter. Transmitting and receiving antennas are lowered separately into nearby boreholes while measurements are taken at various depths. The antennas obtain electromagnetic data used to create images reflecting where objects, structures, and formations are located underground.

Measuring aquifer electrical resistance is done by using a three-dimensional array of electrodes placed in the ground near the sparge area. A detailed picture of air distribution patterns created by the sparging process is developed from the data.

Miniaturized in-situ pressure sensors are deployed in the subsurface to determine pressure differentiation within the sparge area and to define horizontal and vertical water and air transport from the sparge region. They are connected to a data acquisition computer system that supplies both power and real-time data transfer.

In-situ groundwater flow sensors are deployed in the subsurface and are capable of detecting very slow flow velocities. The technology uses a thin cylindrical heater and thermistor system buried vertically in the water-saturated zone. Groundwater flow past the heater changes the probe surface temperature, developing variations that reflect the direction and magnitude of the flow. A three-dimensional groundwater flow pattern can be recorded with a single sensor for a given area.

Results/Conclusions:

The flow sensors positioned at 14 ft bgs and 22 ft bgs were able to capture groundwater flow cells that develop due to the sparge air flow and agrees fairly well with the historical background. Pressure sensors (78 ports), just below the water table, was able to detect the hydrostatic pressure gradient in the aquifer - water table level and effects from the capillary fringe. The borehole radar system data was inconclusive in depicting preferential air channeling development do to sparged air.

Publications:

Wardwell, D., "In Situ Monitoring of Air Sparging, Port Hueneme, California", Mission Research Corp., Task 1A Final Report, Vol. ll Test preparation, April 1997